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EXPANSION JOINT

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Granted to Yuba Consolidated Industries, Inc., Buffalo, New York, U.S.A.

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No. OF CLAIMS 11

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This invention relates generally to the expansion joint art, and more particularly to a new and useful externally guided expansion joint of the packless type.

It is a primary object of my invention to provide an expansion joint adapted to interconnect sections of pipe line and the like spaced apart in generally endwise relation and having an external guide providing a positive guiding action and maintaining proper guiding alinement.

Another object of my invention is to provide an externally guided expansion joint of this type having means for arresting blow-by in the event of rupture in the corrugated tubing.

Still another object of my invention is to provide an expansion joint having the foregoing characteristics and which is simple and relatively inexpensive in construction, readily fabricated and assembled, and durable and dependable in operation.

An expansion joint constructed in accord with my invention is characterized in one aspect thereof by the provision of corrugated tubing secured adjacent its opposite ends to a pair of opposite end members, for spanning the space between pipe line sections spaced apart in generally endwise relation, a guide positioned externally of the tubing in spaced relation thereto and extending axially of the tubing with means supporting the guide adjacent one end in fixed relation to one of the end members, thereby to provide and maintain positive guiding alignment, together with a member carried by the tubing or the other end member for movement therewith and having an outer periphery in sliding engagement with the guide at spaced points around the tubing,

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thereby guiding and stabilizing the tubing during expansion and contraction thereof.

In another aspect thereof, an expansion joint constructed in accord with my invention is characterized by the provision of corrugated tubing secured adjacent its opposite ends to a pair of opposite end members, a guide positioned externally of the tubing in spaced relation thereto and extending axially of the tubing with means supporting the guide adjacent one end in fixed relation to one of the end members thereby to provide and maintain positive guiding alignment, together with a ring having an inner periphery extending between adjacent corrugations of the tubing for supporting the same and an outer periphery in sliding engagement with the guide at spaced points around the tubing, thereby simultaneously reinforcing and stabilizing the tubing during expansion and contraction thereof, the ring being confined to the groove between a single pair of adjacent corrugations.

The foregoing and other objects, advantages and characterizing features of an externally guided expansion joint constructed in accord with my invention will become clearly apparent from the ensuing detailed description of a presently preferred embodiment of my invention, and certain modifications thereof, in conjunction with the accompanying drawing illustrating the same wherein like reference numerals denote like parts throughout the various views and wherein:

Fig. 1 is a longitudinal, quarter-sectional view of an externally guided expansion joint of my invention, showing the same in contracted position;

Fig. 2 is a corresponding view, but showing a

greater number of stabilizing rings and illustrating the joint in expanded position;

Fig. 3 is a fragmentary, longitudinal, quarter-sectional view thereof illustrating a sealing arrangement for arresting blow-by;

Fig. 4 is a view corresponding to Fig. 3, but showing a modified end ring;

Fig. 5 is a fragmentary, elevational view of a joint position indicating arrangement; and

Fig. 6 is a fragmentary, longitudinal sectional view thereof.

Referring now in detail to the forms of my invention illustrated in the accompanying drawing, and particularly to the embodiments of Figs. 1-3, an externally guided expansion joint constructed in accord with my invention comprises a pair of opposite end members generally designated 1 and 2 adapted for connection to sections of pipe line and the like, not illustrated, which are spaced apart in generally axial or endwise relation. End members 1 and 2 each comprise a cylindrical member 3 having a laterally projecting, annular flange 4 secured thereto, as by weldments, the flanges 4 being apertured for being secured to the pipe line sections by bolts or other such fastenings.

The element for absorbing expansion and contraction comprises a tubing, generally designated 5 formed with annular corrugations 6 throughout its intermediate portion. The opposite end portions of tubing 5 extend through the end members 1 and 2 and are lapped over the flanges 4 thereof as indicated at 7. The inner ends of members 3 are

rounded, as indicated at 8, to conform to and support the tubing 5 adjacent the outer root end portions of the end corrugations 6.

The root portions between adjacent corrugations 6 are supported and reinforced in most instances by simple rings 10 which can be of continuous, one-piece construction and have the circular cross-sectional shape illustrated in the drawing, and in the remaining instances by reinforcing and stabilizing rings 11 having root portions 12 of generally tear-shaped cross sectional configuration comprising the inner periphery thereof and extending into the space between certain of adjacent corrugations 6 for supporting the tubing 5 thereat. In the particular joint illustrated in Fig. 1, only one stabilizing ring 11 is provided, although a greater number of rings 11 can be used, as illustrated in Fig. 2.

Ring 11 is a one-piece member, which can be formed in place as one piece or comprise two or more sections welded together, and has a generally cylindrical outer peripheral surface 12' which has sliding engagement with an external guide in the form of a sleeve 13. Because of its sliding engagement with sleeve 13, ring 11 is guided thereby and therefore functions to stabilize, as well as reinforce, the tubing 5 during expansion and contraction thereof.

It is a particular feature of my invention that the sleeve 13 is supported in fixed relation to one end of expansion and contraction absorbing tubing 5, this being accomplished by securing it to a lateral, annular mounting end flange 14 in turn secured to the member 3 of end member

1, the members 13, 14 and 3 preferably being welded together, as illustrated. Therefore, during initial fabrication of the joint exact alignment of sleeve 13 with tubing 5 is readily provided, and this exact, positive alignment is maintained because the sleeve 13 is permanently fixed in position relative to end member 1 and that end of tubing 5.

To limit contraction movement of tubing 5 a first stop is positioned in the path of movement of the stabilizing ring 11, on the side thereof adjacent end member 1, this being conveniently provided in the form of a stop sleeve 15 within guide sleeve 13 and secured to the mounting flange 14, as by welding. Adjacent its opposite end, sleeve 13 can carry an internal ring 16, which is positioned in the path of movement of an annular flange 17 secured to the member 3 of the opposite end member 2, as by welding. Ring 16 thereby functions as a second stop, limiting expansion movement of tubing 5. Sleeve 15 is adapted to abut ring 11, and ring 16 is adapted to abut flange 17, these parts being designed and arranged so that expansion and contraction of tubing 5 is held within a predetermined range.

Thus, it will be seen that the stabilizing ring 11 reinforces the tubing 5 between adjacent corrugations 6, because of its root portion 12 which contoured to receive such corrugations during contraction and the intermediate root portion thereof during expansion, and at the same time stabilizes the tubing 5 against lateral flexing because it is guided by the sleeve 13 during expansion and contraction of the tubing. A limit to contraction is provided by engagement of the stabilizing and reinforcing ring

with the stop sleeve 15, and a limit to expansion is provided by engagement of the flange 17 with the stop 16.

All of the foregoing is accomplished with a very simple construction comprising relatively few parts which are easily fabricated and assembled. It will be observed that the various flanges, end members, stops and sleeves all are simple, conventional, structural fabrications. The end members 1 and 2 are conveniently assembled in the form shown, with the stop sleeve 15 welded in place on flange 14. Then, the sleeve 13, to which stop ring 16 previously has been welded is simply slipped over end member 2, tubing 5 and ring 11, and then welded to flange 14 in proper positional alignment with the remainder of the joint. This is accomplished expeditiously, and relatively inexpensively, and provides a permanent, positive guide maintaining the desired alignment throughout the life of the joint because there are no adjustable fastening or the like which are apt to work loose and permit parts to become misaligned.

It is another feature of my invention that whereas in many expansion joints it is necessary to provide equalizing rings, corresponding to the stabilizing ring 11, between each pair of adjacent corrugations, in the joint of my invention it is usually necessary to use only one ring 11, as in Fig. 1, or a few thereof spaced apart along the expansion joint, as in Fig. 2, with the simple endless root reinforcing rings 10 between the remaining pairs of adjacent corrugations 6. This makes the joint of my invention semi-equalizing. Of course, if desired rings 11 could be used throughout to provide a full equalizing joint, but it is an important advantage of my invention that a joint having

a high degree of strength and stability is provided using only one or a very few such rings 11, in conjunction with the simpler and less expensive rings 10. In other words, the major portion of the rings 11, which otherwise might be provided, can be replaced by the simpler, lighter and less expensive rings 10. For some purposes, the rings 11 could be completely dispensed with, providing a non-equalizing joint guided by flange 17 in conjunction with sleeve 13. The question of what rings 10 and/or 11 should be used, and how many thereof are required, is determined by the internal pressure to which the expansion joint is subjected.

It will be observed that each ring 11 operatively engages between only one pair of adjacent corrugations, and where multiple rings 11 are provided it is contemplated that each ring 11 will be independent of the others. In this way the corrugations are capable of individual expansion and contractions while being reinforced and stabilized, as contrasted with operation when reinforcing members encompassing several corrugations are used.

In addition to functioning as a positive, external guide, the sleeve 13 comprises a housing for the joint and protects the tubing 5 against the accumulation of dirt and debris which otherwise might fall between adjacent corrugations 6 thereof and impair proper functioning of the joint. It also protects the tubing 5 against blows which the joint might accidentally receive in service.

Further, where it is desired to arrest blow-by in the event of rupture of tubing 5, this is readily accomplished with the joint of my invention by providing, on the

end flange 17, piston rings or other sealing means which are in sealing engagement with the guide sleeve 13. This is illustrated in Fig. 3, for example, where there is shown an end flange 17' carrying two piston rings 18. Of course, a different number of piston rings 18 can be used, if desired, or two or more of them can be provided in each groove provided therefor on the end flange 17'. In either case, end flange 17' comprises the movable end wall of a completely enclosed annular housing around tubing 5 which housing is defined by guide sleeve 13, and flanges 14 and 17', and tubing 5. Therefore, should tubing 5 rupture at any point between end members 1 and 2, the resulting blow-by would be arrested because of the sealing engagement provided by piston rings 18 between movable flange 17' and guide sleeve 13, thereby substantially confining the escaping fluid reducing the loss normally accompanying any such rupture to a very low figure.

Fig. 4 illustrates a joint of my invention provided with a weld end, wherein the movable flange 17'' has an axial, annular flange 22 seated on a first stepped portion 23 of an annular nipple 19 and welded to the latter. Nipple 19 has a beveled outer end 24 adapted for welding to a pipe line. The end 7' of tubing 5 seats on a second stepped portion 25 of nipple 19 and is welded thereto, the flange 22 having an annular recess 26 to accommodate the weld.

Also, often it is desired to know the condition of expansion, or contraction, of tubing 5, and this is readily accomplished in accord with my invention by providing an axially elongated slot 20 through the wall of guide sleeve 13, through which slot extends an indicator 21 carried by end

flange 17. Indicator 21 moves along slot 20 with movement of flange 17, cooperating with indicia 21' to indicate the total condition of expansion or contraction of tubing 5.

Of course, the indicating arrangement illustrated in Figs. 5 and 6 would not be used where it is desired to provide an end flange such as 17' or 17'' in sealing engagement with the guide sleeve 13, although in that case it would be possible to provide an indicator carried by the flange 17' or 17'' but projecting axially beyond sleeve 13 and then laterally, all as indicated diagrammatically at 21'' in Fig. 4.

It is another important feature of my invention that all of the foregoing is provided in a joint adapted to span, and enclose, the space between endwise spaced apart pipe sections, without requiring pipe line ends of unusual or special configuration or construction.

Where it is desired to eliminate turbulence and minimize fluid friction, an internal sleeve can be secured, as to an end member 1 or 2, in telescoping relation to tubing element 5.

Accordingly, it is seen that my invention fully accomplishes its intended objects. While only the details of certain presently preferred forms thereof have been illustrated and described herein, I do not thereby mean to imply that my invention is limited to such details. Instead, I am aware that the illustrated forms of my invention can be varied and modified without departing from the spirit of my invention or the intended scope of the appended claims. Also, while my invention is particularly applicable to an expansion joint between pipe lines, and the like, it is not

necessarily limited thereto and can find utility in other situations where it is desired to provide an externally guided device capable of expansion and contraction in the manner of my invention.

The embodiments of the invention in which an exclusive property or privilege is claimed are defined as follows:

1. An externally guided expansion joint comprising, opposite end members, a length of annularly corrugated tubing capable of axial expansion and contraction secured adjacent its opposite ends to said end members, laterally substantially rigid guide sleeve means positioned externally of said tubing in spaced encircling relation thereto and extending axially thereof between said end members, means supporting said guide sleeve means adjacent one end thereof in fixed relation to one of said end members, and a ring positioned about said tubing intermediate said end members, the inner periphery of said ring being confined between a single pair of adjacent corrugations of said tubing in reinforcing relation thereto, and the outer periphery of said ring having sliding engagement with said guide sleeve means at spaced points around said tubing, whereby said ring simultaneously reinforces and stabilizes a portion of said tubing during such expansion and contraction thereof, wherein said guide sleeve means has an axially elongated slot therein, together with an indicator and means mounting the same for movement with the other of said end members, said indicator extending through said slot exteriorly of said guide sleeve means for indicating the condition of relative expansion of said tubing.

2. An externally guided expansion joint comprising, opposite end members, a length of annularly corrugated tubing capable of axial expansion and contraction secured adjacent its opposite ends to said end members, laterally substantially rigid guide sleeve means positioned externally of said tubing in spaced encircling relation thereto and extending axially thereof

between said end members, means supporting said guide sleeve means adjacent one end thereof in fixed relation to one of said guide sleeve means adjacent one end thereof in fixed relation to one of said end members, and a ring positioned about said tubing intermediate said end members, the inner periphery of said ring being confined between a single pair of adjacent corrugations of said tubing in reinforcing relation thereto, and the outer periphery of said ring having sliding engagement with said guide sleeve means at spaced points around said tubing, whereby said ring simultaneously reinforces and laterally stabilizes a portion of said tubing during such expansion and contraction thereof, wherein said guide sleeve means encloses said tubing and said means supporting said guide sleeve means adjacent said one end thereof includes means closing the space between said tubing and said guide sleeve means at said one end of the latter, an external lateral flange carried by the other of said end members for movement therewith interiorly of said guide sleeve means, and sealing means carried by said other end member flange in sliding engagement with said guide sleeve means, thereby to arrest blow-by in the event of rupture of said tubing.

3. An expansion joint comprising, a pair of end members, a length of annularly corrugated tubing capable of axial expansion and contraction secured adjacent the opposite ends thereof to said end members, a laterally substantially rigid guide sleeve surrounding said tubing in spaced relation thereto, means supporting said guide sleeve adjacent one end thereof in fixed relation to one of said end members, a ring around said tubing between said end members in axially spaced relation thereto, the inner periphery of said ring extending between a

single pair of adjacent corrugations of said tubing and being confined therebetween in supporting relation thereto, the outer periphery of said ring extending into sliding engagement with said guide sleeve at spaced points around said tubing for being guided by said sleeve during expansion and contraction of said tubing, whereby said tubing is both reinforced and stabilized during expansion and contraction thereof, first stop means positioned in the path of movement of said ring on the same side thereof as said one end member for abutting said ring and thereby limiting contraction of said tubing, an external lateral flange carried by the other of said end members for movement therewith, and second stop means positioned in the path of movement of said flange on the side thereof opposite said ring for abutting said flange and thereby limiting expansion of said tubing.

4. An expansion joint as set forth in claim 3, wherein the space between said one end member and said one end of said guide sleeve is closed, together with sealing means carried by said flange in sealing engagement with said guide sleeve to arrest blow-by in the event of rupture of said tubing.

5. An expansion joint as set forth in claim 3, wherein said first stop means comprises a sleeve inside said guide sleeve adjacent said one end thereof, and said means supporting said guide sleeve in fixed relation to said one end member comprises mounting means common to said stop sleeve and said guide sleeve and carried by said one end member.

6. An expansion joint as set forth in claim 5, wherein said second stop means comprises an internal ring carried by said guide sleeve adjacent the other end thereof.

7. An expansion joint comprising, a pair of end members, a length of annularly corrugated tubing capable of axial expansion and contraction secured adjacent the opposite ends thereof to said end members, a mounting flange carried by one of said end members in fixed relation thereto, a laterally substantially rigid guide sleeve carried by said mounting flange in fixed relation thereto and surrounding said tubing in spaced relation thereto, a ring positioned around said tubing between said end members, the inner periphery of said ring supporting said tubing between a single pair only of adjacent corrugations thereof and the outer periphery of said ring having guided engagement with said guide sleeve, whereby said tubing is simultaneously reinforced and stabilized by said ring during expansion and contraction, a stop sleeve carried by said mounting flange internally of said guide sleeve and in the path of movement of said ring, thereby to limit contraction of said tubing, an external lateral flange carried by the other of said end members for movement therewith, and an internal stop ring carried by said guide sleeve in the path of movement of said other end member flange thereby to limit expansion of said tubing.

8. An externally guided expansion joint interconnecting sections of pipe line and the like in spaced apart generally endwise relation comprising, in combination with two pipe line sections arranged in generally endwise spaced apart relation, a pair of opposite end members connected to said pipe line sections, a length of annularly corrugated tubing capable of axial expansion and contraction secured adjacent its opposite ends to said end members thereby to absorb expansion and contraction of said pipe line sections, laterally substantially rigid guide means positioned externally of said tubing in spaced relation thereto and extending axially thereof between said end members, means supporting said guide means adjacent one end thereof in fixed relation to one of said end movements, a member positioned between a single pair of adjacent corrugations of said tubing

for movement therewith and having an outer periphery in sliding engagement with said guide means at spaced points around said tubing, thereby laterally stabilizing said tubing during such expansion and contraction thereof, an external flange carried by the other of said end members for movement therewith, and stop means carried by said guide means adjacent the other end thereof in the path of movement of said end member flange thereby to limit expansion movement of said tubing.

9. An externally guided expansion joint interconnecting sections of pipe line and the like in spaced apart generally end-wise relation comprising, a pair of opposite end members, a length of annularly corrugated tubing capable of axial expansion and contraction secured adjacent its opposite ends to said end members, laterally substantially rigid guide means positioned externally of said tubing in spaced relation thereto and extending axially thereof between said end members, means supporting said guide means adjacent one end thereof in fixed relation to one of said end members, a ring positioned about said tubing intermediate said end members, the inner periphery of said ring extending between adjacent corrugations of said tubing in reinforcing relation thereto, and the outer periphery of said ring having sliding engagement with said guide means at spaced points around said tubing, whereby said ring simultaneously reinforces and stabilizes said tubing during such expansion and contraction thereof, said ring being confined to the groove between a single pair of adjacent corrugations of said tubing, an external flange carried by the other of said end members for movement therewith, and stop means carried by said guide means adjacent the other end thereof in the path of movement of said end member flange thereby to limit expansion movement of said tubing.

10. An expansion joint as set forth in claim 4, together with an indicator carried by said flange for movement therewith, said indicator extending around the other end of said guide sleeve to the exterior thereof.

11. An externally guided expansion joint interconnecting sections of pipe line and the like in spaced apart generally endwise relation comprising, in combination with two pipe line sections arranged in generally endwise spaced apart relation, a pair of opposite end members connected to said pipe line sections, a length of annularly corrugated tubing capable of axial expansion and contraction secured adjacent its opposite ends to said end members thereby to absorb expansion and contraction of said pipe line sections, laterally substantially rigid guide sleeve means positioned externally of said tubing in spaced relation thereto and extending axially thereof between said end members, means supporting said guide means adjacent one end thereof in fixed relation to one of said end members, and a ring positioned about said tubing intermediate said end members, the inner periphery of said ring extending into the space between a single pair only of adjacent corrugations of said tubing in reinforcing relation thereto, and the outer periphery of said ring having sliding engagement with said guide means at spaced points around said tubing, whereby said ring simultaneously reinforces and laterally stabilizes a portion of said tubing during such expansion and contraction thereof, together with an external rigid lateral flange carried by the other of said end members for movement therewith interiorly of said sleeve means, and positive stop means carried by said sleeve means adjacent the other end thereof in the path of movement of said end member flange thereby to limit expansion movement of said tubing.

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Fig.1.

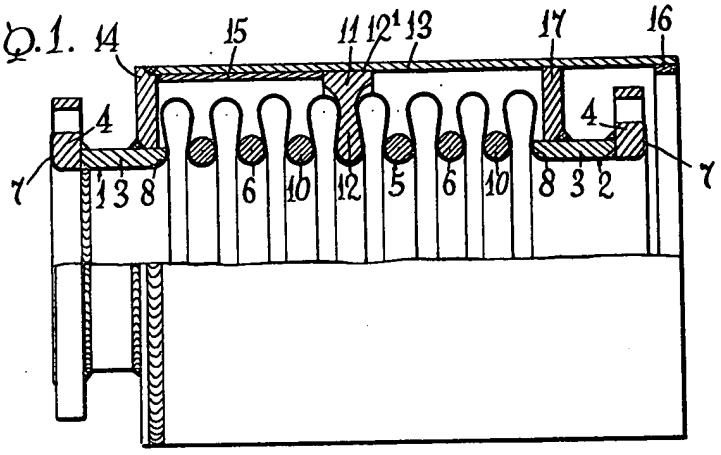

Fig.2.

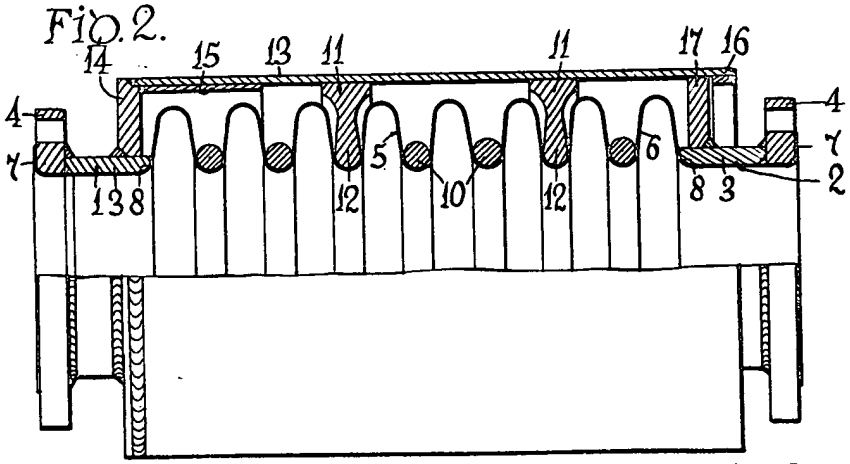

Fig.5.

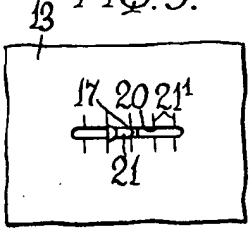

Fig.4.

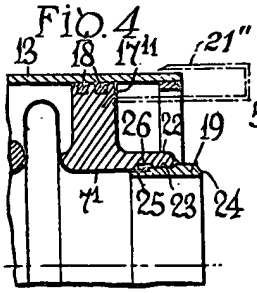

Fig.3.

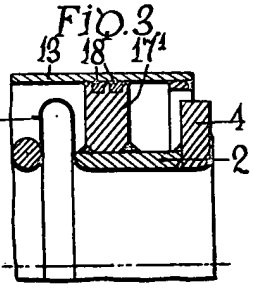

Fig.6.